ON A CASE OF PRESUMED VIVIPARITY IN *LIMICOLARIA*.

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In September of the present year Mr. H. B. Preston received some living specimens of *Limicolaria* from South-West Uganda and Belgian Congo. Two species were represented—*L. Smithi* and a new species as yet undescribed. After some time the uterus, in both cases, was found to be full of apparently well-developed young. In view of the fact that viviparity is not a phenomenon of frequent occurrence among Mollusca the matter was deemed worthy of some consideration, and Mr. Preston kindly handed the specimens over to me to report upon.

In the new species the young are well advanced, are all totally free from any envelope, and already show traces of coloration upon the shell. In *L. Smithi*, however, the majority are still encased in a thin membrane of a soft and pliant nature which is attached to the mouth-region by a chalaza-like structure, remains of which are to be seen in the young of the previously mentioned species. The young of *L. Smithi* are fairly well developed, and the shell has advanced considerably beyond the rudimentary stage. The envelope has disappeared over nearly all the region opposed to the aperture of the shell. The parent in this case contained also three or four eggs with hard shells. These had been perforated in situ in two or more places, and contained only some loose tissue of doubtful nature.

The specimen of the unnamed species certainly, then, is viviparous. Can we say the same of the specimens of *L. Smithi*? The young were certainly encased in a membrane; but as a matter of fact the latter in nearly all cases was frayed away and perforated over all the aperture of the shell. On considering the difference in degree of development between the two species I am inclined to think that the condition seen in *L. Smithi* is an early stage of the complete freedom from enveloping structures seen in the new species.

The question that arises out of these data is whether this is actually a case of normal viviparity, and further whether the genus *Limicolaria* as a whole is viviparous.

We may briefly deal with the latter consideration by saying that, as far as can be made out, no references to the reproduction of this genus are to be found in the literature of Pulmonate ontogeny. *Achatina*, a very near relative, has several ovoviviparous species (1, 2, 3).

Turning to our first question, we should be careful before we accept this evidence as proving that *Limicolaria* is viviparous. It is possible that the young in these two species may have been retained longer in the uterus of the parent than is natural under ordinary circumstances, owing to the change in environment to which they had been subjected.

Transference from a tropical climate to that of England may well have caused a normally ovoviviparous or oviparous animal to become viviparous. I believe a similar result was achieved (artificially) by Kämmerer (4), who has changed the mode of reproduction in *Salamandra* by alteration of the environmental conditions. Unfortunately I have not been able to verify the facts of this experiment, but I believe *S. maculosa* ordinarily keeps its embryos a short time in the uterus, and eventually they are hatched out as larvæ. If, however, the temperature is lowered, the ova remain a longer time in the uterus, and the larval stages are suppressed.

I have mentioned the fact that the eggs which were found in *L. Smithi* were perforated, and a good part of their contents absent. In addition several of the young in the new species had holes in their shells, and the integument of the foot and mantle seemed to be frayed and torn. It suggests itself to me that we have here a case of inter-uterine cannibalism, in which, owing to the inability of the young to obtain food as the result of their delayed delivery from the parental uterus, they were forced to obtain their supply of food and calcareous matter from each other. Such a phenomenon undoubtedly does occur as a natural process among Mollusca. Cases are known among the Streptoneura in which the embryos devour one another and have developed as a consequence larval excretory organs. An especially interesting case is recorded by Glaser (5) in his account of the development of *Fasciolaria*. I am indebted to Dr. Jenkinson, lecturer in Embryology in the University of Oxford, for reminding me of this instance. The difference between it and the phenomena under consideration in this paper is of course that in *Fasciolaria* it is of regular occurrence and constitutes part of the necessary events of ontogeny, while in *Limicolaria* I presume it to be exceptional in its occurrence. Lastly, as a point of detail, in *Fasciolaria* the cannibal embryos and their victims are all within the same capsule, which is not the case in *Limicolaria*.

Bibliography.

1. Semper, Sitzb. Phys. Med. Ges. Wurzburg, 1886.
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3. Pelseneer, Mollusca (Lankester's Treatise), p. 131.
4. Kämmerer, Archiv. Entw. Mechanik, vols. xvii, xxii.
5. Glaser, Biological Bulletin, vol. x.